

CLAIMS

The invention claimed is:

1. A vehicle transporter comprising:
 - (a) a vehicular frame;
 - (b) a vehicle support member movable relative to said vehicular frame; and
 - (c) a screw actuator having elongate members that slide longitudinally relative to each other in response to turning of a screw so as to alter a length of said actuator, and having a connection to said vehicular frame and a connection to said vehicle support member so that altering said length of said screw actuator will cause said vehicle support member to move relative to said vehicular frame.
2. The vehicle transporter of claim 1 wherein said screw actuator comprises:
 - (a) a tubular shell connectible to one of said vehicular frame and said vehicle support member, said tubular shell comprising a wall defining an exterior and an interior;
 - (b) a slide tube having a first end having a connectible to the other of said vehicular frame and said vehicle support member, a second end, and a slide tube wall connecting said first end and said second end and defining a slide tube interior and a slide tube exterior, said slide tube exterior being slidably arranged in said interior of said tubular shell;
 - (c) a guide in sliding engagement with said slide tube interior;
 - (d) a screw having a threaded portion, a rotationally supported first end arranged for rotation of said screw in said interior of said tubular shell, and a second end rotatably supported by said guide; and
 - (e) a nut constrained to translate with said slide tube and in threaded engagement with said threaded portion of said screw so that rotation of said screw will cause said slide tube to translate in said tubular shell altering said length of said screw actuator.
3. The vehicle transporter of claim 2 wherein said screw actuator further comprises a follower nut in threaded engagement with said screw and in sliding engagement with said interior of said tubular shell.

4. The vehicle transporter of claim 2 wherein said screw actuator further comprises a motor including a frame connected to said tubular shell and a shaft rotatable in said frame and drivingly connected to rotate said screw.
5. The vehicle transporter of claim 2 wherein said threaded portion of said screw is arranged so that said threaded engagement of said nut and said screw is self-locking to prevent forces tending to translate said slide tube from causing rotation of said screw.
6. The vehicle transporter of claim 2 wherein said threaded portion of said screw comprises an Acme thread having a lead angle not exceeding five degrees.
7. The vehicle transporter of claim 2 wherein at least one of said tubular shell and said slide tube is connectible to one of said vehicular frame and said vehicle support member by a pivotal connection.
8. The vehicle transporter of claim 7 wherein said screw actuator further comprises a follower nut in threaded engagement with said screw and in sliding engagement with said interior of said tubular shell.
9. The vehicle transporter of claim 7 wherein said screw actuator further comprises a motor including a frame attached to said tubular shell and a shaft rotatable in said frame and drivingly connected to rotate said screw.
10. The vehicle transporter of claim 9 wherein said tubular shell is connectible to one of said vehicular frame and said vehicle support member with a pivoting connection enabling said motor and said tubular shell to pivot in unison.
11. The vehicle transporter of claim 7 wherein said threaded portion of said screw is arranged so that said threaded engagement of said nut and said screw is self-locking to prevent forces tending to translate said slide tube from causing rotation of said screw.

12. A vehicle transporter comprising:
- (a) a vehicular frame;
 - (b) a vehicle support member having a pivotally supported first end and a second end; and
 - (c) a screw actuator having elongate members that slide longitudinally relative to each other in response to turning of a screw so as to alter a length of said actuator, and having a connection to said vehicular frame and a connection to said vehicle support member so that altering said length of said screw actuator will cause at least said second end of said vehicle support member to move relative to said vehicular frame.
13. The vehicle transporter of claim 12 wherein said screw actuator comprises:
- (a) a tubular shell pivotally connectible to one of said vehicular frame and said vehicle support member, said tubular shell comprising a wall defining an exterior and an interior;
 - (b) a slide tube having a first end, said first end having a pivotal connection to the other of said vehicular frame and said vehicle support member; a second end; and a slide tube wall connecting said first end and said second end and defining a slide tube interior and a slide tube exterior, said slide tube exterior being slidably arranged in said interior of said tubular shell;
 - (c) a guide in sliding engagement with said slide tube interior;
 - (d) a screw having a threaded portion, a first rotationally supported end arranged for rotation of said screw in said interior of said tubular shell, and a second end rotatably supported by said guide; and
 - (e) a nut constrained to translate with said slide tube and in threaded engagement with said threaded portion of said screw so that rotation of said screw will cause said slide tube to translate in said tubular shell altering said length of said screw actuator.
14. The vehicle transporter of claim 13 wherein said screw actuator further comprises a follower nut in threaded engagement with said screw and in slidable relative to said interior of said tubular shell.

15. The vehicle transporter of claim 13 wherein said screw actuator further comprises a motor including a frame attached to said tubular shell and a shaft rotatable in said frame and drivingly connected to rotate said screw.
16. The vehicle transporter of claim 13 wherein said threaded portion of said screw is arranged so that said threaded engagement of said nut and said screw is self-locking to prevent forces tending to translate said slide tube from causing rotation of said screw.
17. The vehicle transporter of claim 12 wherein said frame includes a substantially horizontal frame beam and connection of said tubular and said slide tube to said transporter define a line that is not normal to said frame beam when said actuator is of at least one length.
18. A vehicle transporter comprising:
- (a) a vehicular frame;
 - (b) a first vehicle support member supported above said vehicular frame and selectively movable relative to said vehicular frame; and
 - (c) a plurality of screw actuators, each comprising:
 - (i) an elongate tubular shell comprising a wall defining an shell exterior and a shell interior, said tubular shell having a pivoting connection to at least one of said vehicular frame and said vehicle support member;
 - (ii) a slide tube having a first end, said first end having a pivotal connection to the other of said vehicular frame and said vehicle support member; a second end; and a slide tube wall connecting said first end and said second end and defining a slide tube interior and a slide tube exterior, said slide tube exterior being arranged to slide within said shell interior;
 - (iii) a guide in sliding engagement with said slide tube interior;
 - (iv) a screw including a threaded portion, a first end rotationally supported and for rotation of said screw in

said shell interior, and a second end rotatably supported by said guide;

- (v) a nut restrained to said slide tube and in threaded engagement with said threaded portion of said screw so that rotation of said screw will cause said slide tube to translate in said tubular shell altering a dimension between said connection of said first end of said slide tube and said connection of said tubular shell causing said first vehicle support member to move relative to said vehicular frame;
- (vi) a follower nut in threaded engagement with said screw and slidably bearing on said shell interior; and
- (vi) a hydraulic motor having a frame attached to said tubular shell and a shaft selectively rotatable in said frame and drivingly connected to said screw.

19. The vehicle transporter of claim 18 further comprising:

- (a) a second vehicle support member pivotally attached at a first end to said first vehicle support member; and
- (b) another screw actuator having a first pivoting connection to said vehicular frame, a second pivoting connection to said second vehicle support member, and elongate members that slide longitudinally relative to each other in response to rotation of a screw to selectively vary a length between said first and said second connections causing said second vehicle support member to pivot about said first end.

20. The vehicle transporter of claim 18 further comprising:

- (a) a third vehicle support member slidably attached to said first vehicle support frame; and
- (b) an additional screw actuator having a first connection to said first vehicle support member, a second connection to said third vehicle support member, and elongate members that slide longitudinally relative to each other in response to rotation of a screw to selectively vary a length between said first and said second connections causing

said third vehicle support member to translate relative to said first vehicle support member.

21. A screw actuator comprising:

- (a) a tubular shell connectible to a first member; said tubular shell comprising a wall defining an exterior and an interior;
- (b) a slide tube having a first end, a second end, and a slide tube wall connecting said first end and said second end and defining a slide tube interior and a slide tube exterior, said slide tube exterior being slidably arranged in said interior of said tubular shell, said slide tube connectible to a second member;
- (c) a guide in sliding engagement with said slide tube interior;
- (d) a screw having a threaded portion and a first end rotationally supported by said guide, said screw arranged for rotation in said interior of said tubular shell; and
- (e) a nut in threaded engagement with said threaded portion of said screw and constrained to translate with said slide tube so that rotation of said screw will cause said slide tube to translate in said tubular shell altering a length between said connection for said first member and said connection for said second member.

22. The screw actuator of claim 21 further comprising a follower nut in threaded engagement with said screw and spaced apart from said nut.

23. The screw actuator of claim 22 further comprising an indicator of contact between said follower nut and at least one of said nut and said slide tube.

24. The screw actuator of claim 21 further comprising a motor including a frame connected to said tubular shell and a shaft rotatable in said frame and drivingly connected to rotate said screw.

25. The screw actuator of claim 21 wherein said threaded portion of said screw is arranged so that a force tending to displace said slide tube will not cause rotation of said screw.

26. The screw actuator of claim 21 wherein said threaded portion of said screw comprises an Acme thread having a lead angle not exceeding five degrees.
27. The screw actuator of claim 21 wherein at least one of said tubular shell and said slide tube is pivotally connectible, respectively, to one of said first member and said second member.
28. The screw actuator of claim 27 further comprising a follower nut in threaded engagement with said screw and spaced apart from said nut.
29. The screw actuator of claim 21 further comprising:
 - (a) a hydraulic motor comprising a frame attached to said tubular shell, said frame including a fluid port, and a shaft rotatable in said frame and drivingly connected to rotate said screw, said shaft rotatable by pressurized fluid at said fluid port; and
 - (b) a hydraulic valve attached to one of said tubular shell and said frame of said hydraulic motor and connected to selectively block a flow of fluid to said fluid port.